# FINAL
# ENVIRONMENTAL ASSESSMENT

# DELTA MANAGEMENT AT FORT ST. PHILIP
# BS-11

**PLAQUEMINES PARISH, LOUISIANA**

**U.S. FISH AND WILDLIFE SERVICE**

**ECOLOGICAL SERVICES**

**LAFAYETTE, LOUISIANA**

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CWPPRA Project BS-11
Plaquemines Parish, Louisiana

# SECTION 1.0 PURPOSE AND NEED FOR PROPOSED ACTION

The purpose of the proposed project is to promote the formation of emergent marsh through the construction of artificial crevasses and earthen terraces near the east bank of the Mississippi River adjacent to Fort St. Philip in Plaquemines Parish, Louisiana. The project area has experienced tremendous loss of emergent marsh since the mid 1970s, with loss rates as high as 8 percent per year. However, many areas are experiencing marsh growth as sediment introduced from the Mississippi River through a natural crevasse is causing the infilling of open water areas. The project is designed to enhance the natural processes of marsh building now occurring in the project area. The need to address coastal Louisiana's severe wetland loss has been identified in numerous restoration plans, programs, and State and Federal laws, and this project would help to fulfill that need.

## SECTION 1.1 INTRODUCTION

Coastal land loss in Louisiana has been reported to be from approximately 25 square miles per year (Dunbar et al. 1992) to 35 square miles per year (Barras et al. 1994) and accounts for 80 percent of the coastal wetland loss in the United States (Louisiana Coastal Wetlands Conservation and Restoration Task Force 1998a). Causes of wetlands loss include sea level rise, subsidence, sediment deprivation, canalization, saltwater intrusion, and altered hydrology (Turner and Cahoon 1987, Turner 1990). Concern over Louisiana's loss of coastal wetlands prompted President George Bush in 1990 to sign into law the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA). U.S. Senator John Breaux was the primary author of the Act. CWPPRA provides over $50 million per year for the planning, design and construction of coastal restoration projects in Louisiana. Each year, a list of projects is selected for implementation and funds are approved for engineering and design. That annual list is referred to as the Priority Project List. The Delta Management at Fort St. Philip Project was funded by the CWPPRA as part of the 10$^{th}$ Priority Project List.

In 1990, the Louisiana Coastal Wetlands Conservation and Restoration Task Force (LCWCRTF) and the Wetlands Conservation and Restoration Authority (WCRA) developed the Coast 2050 Plan which serves as the official restoration plan for coastal Louisiana (LCWCRTF and WCRA 1998*a*). The Coast 2050 Plan divided the Louisiana coastal zone into four regions encompassing nine hydrologic basins, and restoration strategies were developed for each region. Each basin was also divided into subbasins or mapping units for which additional strategies were developed. The Coast 2050 Plan will be implemented using a number of different funding sources including the CWPPRA, the Water Resources Development Act, and the State's Coastal Wetlands Conservation and Restoration Fund.

The Delta Management at Fort St. Philip Project is located within Region 2, which encompasses the Barataria Basin, Breton Sound Basin, and Mississippi River Delta Basin. The project area is located at the southern end of the Breton Sound Basin, which is bounded by the Mississippi River on the west, Bayou Terre aux Boeufs on the north, the Mississippi River Gulf Outlet on the east and Baptiste Collette Bayou on the south (Figure 1). The Breton Sound Basin consists predominantly of brackish and saline marshes and is interspersed with several large bays, lakes, and other open water habitat. Isolated pockets of fresh and intermediate marsh exist in the upper part of the basin near Big Mar and Lake Lery and in the southern part of the basin near Fort St. Philip. The basin is a remnant of the St. Bernard Delta and contains several abandoned distributary channels including Bayou Terre aux Boeufs, Bayou La Loutre, River aux Chenes, and Bayou Lamoque. An important feature of the basin is the Caernarvon Freshwater Diversion structure which diverts Mississippi River water into the upper part of the basin near Big Mar.

Historically, the Breton Sound Basin was characterized by a normal gradation of freshwater habitats in the upper end to brackish and saline marshes at the lower end. Water entered the basin through the many distributary channels and overbank flow during flood events. Marshes in the interdistributary basins were essentially unbroken, and fresh water and sediments from the Mississippi River nourished the area and maintained the natural gradient of fresh habitat near the river to saline marsh along the bays surrounding Breton Sound. As the flow of fresh water and sediments from the Mississippi River was restricted by flood protection levees, the basin began to gradually deteriorate from saltwater intrusion, subsidence, wave action, and sediment deprivation. From 1932 to 1990, the basin lost over 45,000 acres of marsh, representing approximately 25 percent of the basin's wetlands (LCWCRTF 1993*a*).

The Coast 2050 Plan divides the Breton Sound Basin into six mapping units or subbasins: 1) Lake Lery, 2) Caernarvon, 3) River aux Chenes, 4) Jean Louis Robin, 5) American Bay, and 6) Breton Sound (Figure 2). The project area is located within the American Bay mapping unit, which contains 143,000 acres of emergent marsh and open water habitats (LCWCRTF and WCRA 1998*b*). Within the American Bay mapping unit, approximately 11,500 acres of emergent marsh were lost from 1932 to 1990. The primary causes of that loss were dredging, subsidence, wave action, and the restriction of fresh water and sediments from the Mississippi River. Subsidence within this unit is high and ranges from 2.1 to 3.5 feet per century (LCWCRTF and WCRA 1998*b*).

The project area has experienced extensive loss of emergent wetlands since 1974. Data from the U.S. Army Corps of Engineers (Corps) indicate a 1974 to 1990 loss rate of 4.10 percent per year for Subarea 1 and 1.61 percent per year for Subarea 2 (Figure 3). Those data also indicate 1983 to 1990 loss rates of 8.52 percent per year and 3.62 percent per year for Subareas 1 and 2, respectively. The causes of marsh loss appear to be subsidence, wind/wave erosion, and possibly scouring of organic marsh soils when river water was introduced through a natural crevasse in

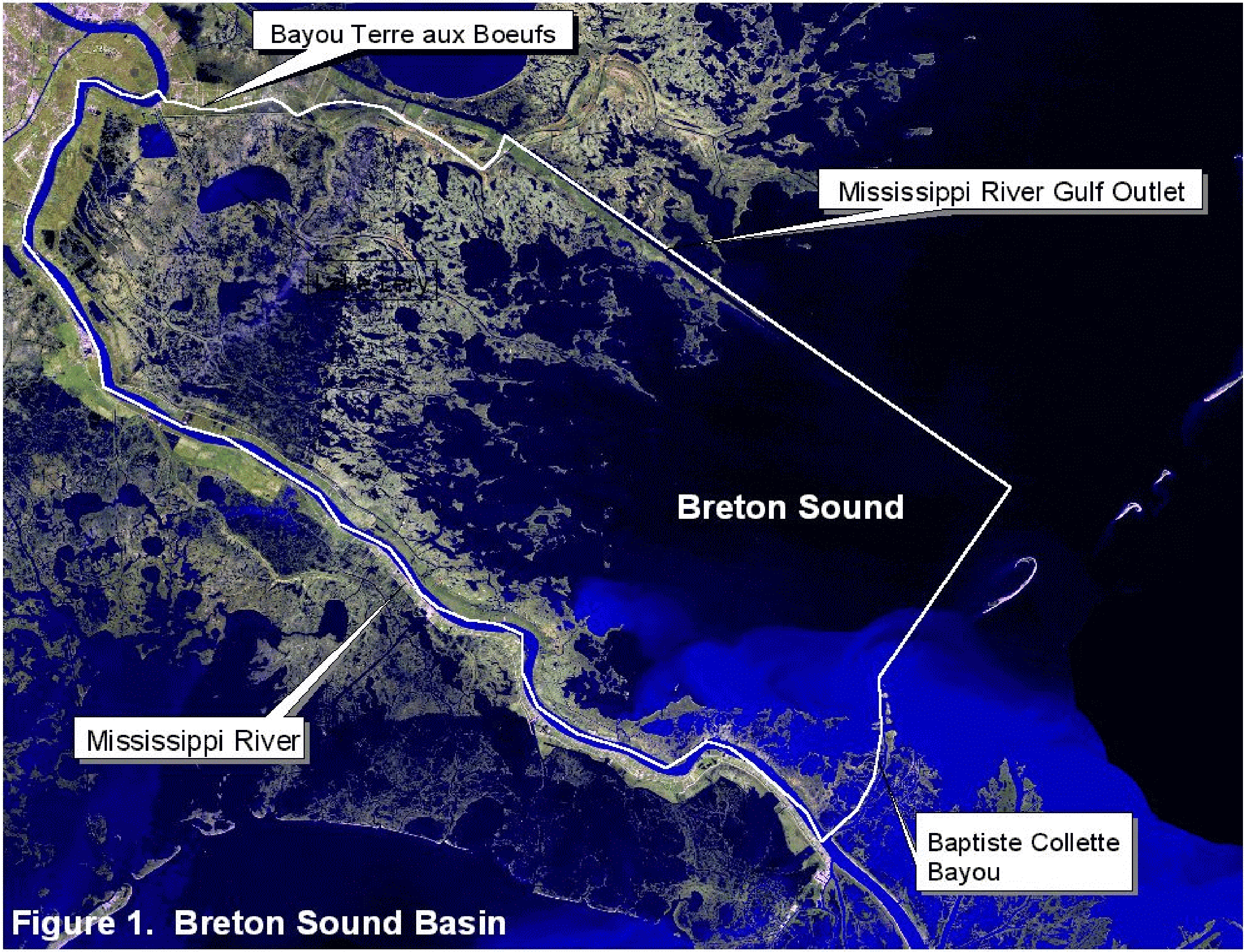


Figure 1. Breton Sound Basin

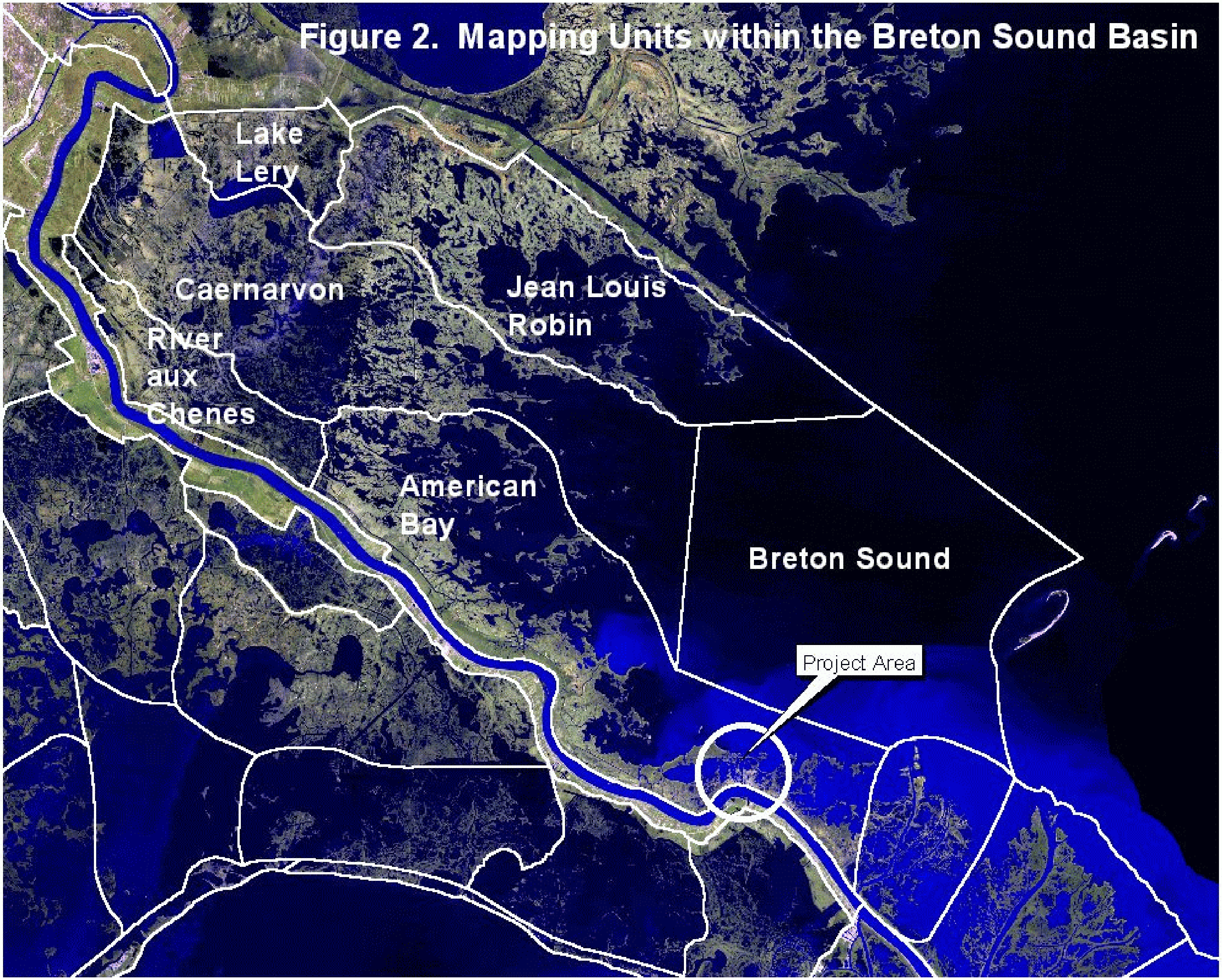
Figure 2. Mapping Units within the Breton Sound Basin
Lake
Lery
Caernarvon
River
aux
Chenes
Jean Louis
Robin
American
Bay
Breton Sound
Project Area

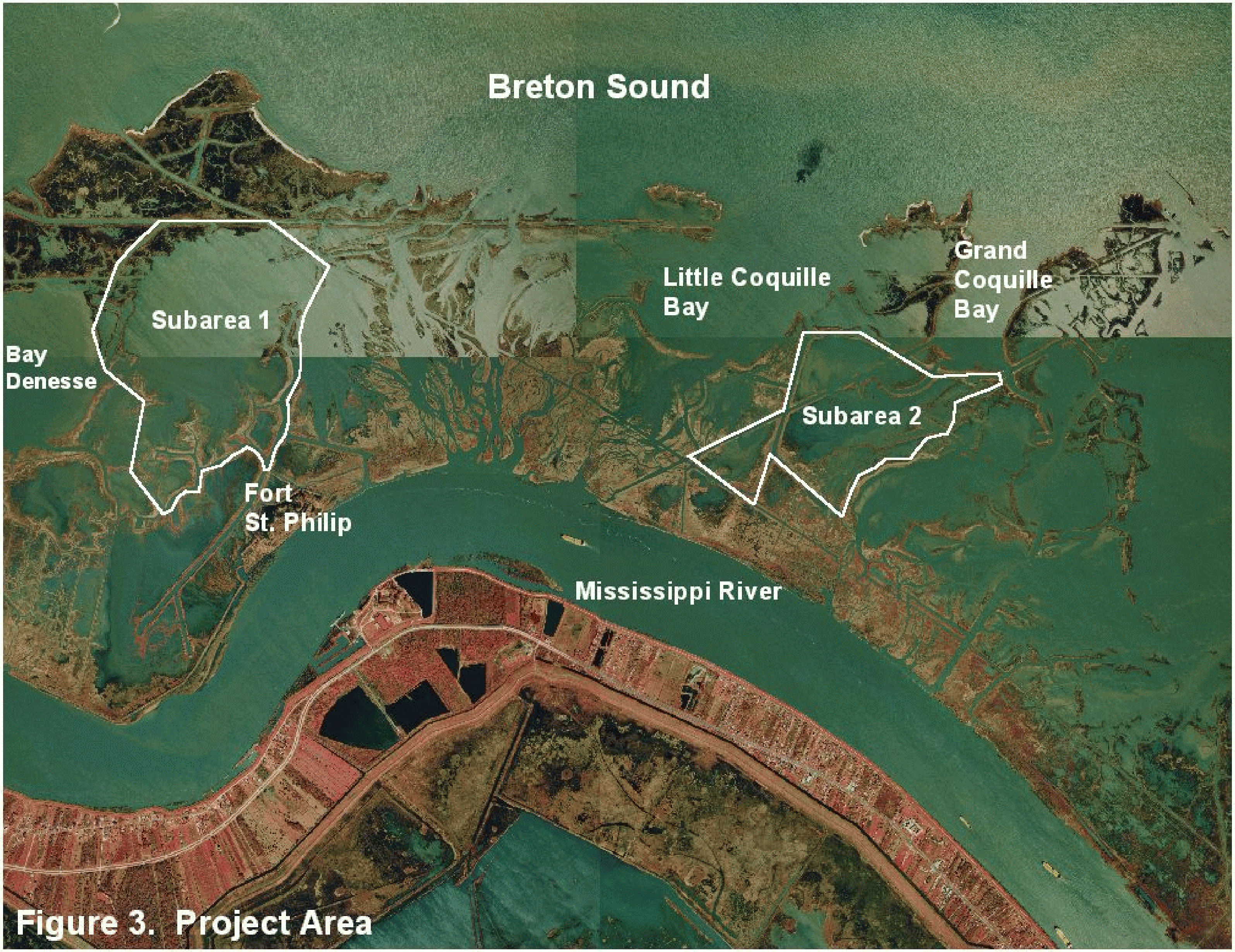

Figure 3. Project Area

the early 1970s, possibly during the 1973 flood. The fringing marsh in this area borders Breton Sound, where wave erosion has caused extensive loss of shoreline marsh.

Although Corps data indicate high marsh loss rates in this area, they do not reflect the accretion of new marsh which has occurred. A comparison of 1990, 1995, and 1998 aerial photography indicates marsh loss in the project area has decreased considerably; marsh building now occurs over a substantial portion of the project area. Open water areas formed by the deterioration and subsequent loss of emergent marsh are becoming shallower with the introduction of riverine sediments, and emergent marsh is forming throughout the area on the newly accreted mineral soils.

Marshes in the Fort St. Philip area are experiencing effects similar to a diversion in the form of a wide, shallow crevasse which formed during the 1973 flood. Before the 1973 flood, a locally constructed levee extended from Bayou Lamoque, which is upstream of the project area, to Baptiste Collette Bayou. That levee restricted the flow of fresh water into the project area except under high river stages. During the 1973 flood, that levee was breached in several locations near Fort St. Philip and has continued to deteriorate from wave energy and the flow of fresh water during high river stages. In 1991, the Corps constructed a revetment approximately 2 miles long on the east side of the Mississippi River near Fort St. Philip. A rock dike was also constructed along the revetment length to provide a stationary anchor point for the work barges. That dike was originally constructed to an elevation of 5 feet NGVD but was degraded to 0.5 feet NGVD for 2,000 feet immediately downstream from Fort St. Philip to allow for continued overbank flow of fresh water. During 2000, the Corps degraded approximately 700 feet of the rock dike to -3 feet NGVD to allow more freshwater flow into the marshes surrounding the project area. The Coast 2050 Plan recommends freshwater and sediment diversions as the primary means of combating marsh loss within the American Bay mapping unit. The Delta Management at Fort St. Philip Project would enhance the natural marsh-building processes occurring as a result of overbank flooding.

The project area has undergone an interesting transition since the early 1970s. U.S. Fish and Wildlife Service (Service) habitat data for 1956 indicates that the area was a nearly unbroken expanse of marsh interspersed with bayous, ponds, and a few pipeline canals. Quadrangle maps from 1971 indicate slightly more open water in the project area. October 1974 aerial photography indicates marsh break-up beginning to occur between Subareas 1 and 2 in the vicinity of the crevasse which apparently formed between 1971 and 1974. Between 1974 and 1978, considerably more marsh deterioration occurred in the immediate outfall of the crevasse and west of the crevasse toward Bay Denesse. From the examination of aerial photographs and Corps land loss data, that trend continued to 1990.

## SECTION 1.2 PURPOSE OF PROPOSED ACTION

Wetlands in the Fort St. Philip area are currently undergoing a period of marsh growth as fresh water, sediments, and nutrients from the Mississippi River flow are introduced throughout the year via a large natural crevasse. Many areas which converted from emergent marsh to open water are now infilling and reverting to emergent marsh. However, erosion continues along the shorelines exposed to the wave energies of Breton Sound and other large bodies of open water. The purpose of the Delta Management at Fort St. Philip Project is to take advantage of the natural marsh-building processes occurring in the area and accelerate marsh growth in open water habitat. Specific goals of the project are to: 1) create 25 acres of emergent marsh through the construction of earthen terraces and vegetative plantings and 2) create an additional 244 acres of emergent marsh by enhancing the natural processes of delta growth in the project area.

### SECTION 1.3 NEED FOR PROPOSED ACTION

Marshes in the Fort St. Philip area experienced a rapid conversion from a nearly unbroken expanse of emergent marsh in 1956 to an area highly fragmented by 1990. Wetland loss rates during the period 1983 to 1990 averaged as high as 8 percent per year. Subsidence rates are 2.5 to 3.1 feet per century. Even though the formation of emergent marsh is expected to continue from sediment input from the Mississippi River, wetland loss will continue to occur in other areas and wetland gain may not offset wetland loss. The proposed action, the Delta Management at Fort St. Philip Project, would increase marsh accretion rates in the area to better offset the ongoing process of marsh deterioration in other areas along the coast.

### SECTION 1.4 REQUIRED DECISIONS

The final decision on the preferred alternative was reached only after a thorough public review and full consideration of all comments. Opportunities for public comment occurred at public meetings conducted during the project development and selection stages during the CWPPRA planning process. Opportunity for public comment was also provided during review of the draft EA. A Notice of Availability was published in the Federal Register on May 24, 2002. In addition, copies of the draft EA were sent to the appropriate Federal, State, and local agencies, and other interested parties. Upon review of public and agency comments, the Service has determined that further environmental documentation (e.g., Environmental Impact Statement) is not necessary and has issued a Finding of No Significant Impact.

### SECTION 1.5 COORDINATION AND CONSULTATION

Planning, engineering and design of this project was coordinated with all LCWCRTF agencies, other natural resource agencies, Plaquemines Parish local officials, and area landowners. Meetings have been held with personnel from the Louisiana Department of Natural Resources, the Natural Resources Conservation Service, the National Marine Fisheries Service, the U.S. Army Corps of Engineers, the Environmental Protection Agency, landowners and lessees to discuss project features. Questions were answered regarding issues of interest to private landowners, parish officials, and government agencies. Support for the project has been expressed by all entities involved.

## SECTION 2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

One action alternative was developed through discussions with the CWPPRA agencies and landowners. That alternative includes the construction of artificial crevasses and terraces to enhance the natural marsh-building processes occurring in the project area. That alternative and a No Action alterative are discussed in the following sections.

## SECTION 2.1 ALTERNATIVE 1 - NO ACTION

Under this alternative, no action would be taken to enhance marsh building in the project area.

## SECTION 2.2 ALTERNATIVE 2 - PREFERRED ALTERNATIVE

The preferred alternative consists of two features, i.e., artificial crevasses and terraces, to promote marsh building in the project area (Figures 4 and 5). During CWPPRA planning activities for the 10th Priority Project List, the Service recognized that opportunities existed near the Fort St. Philip area to enhance natural marsh-building processes occurring in that area as a result of a large crevasse off of the Mississippi River. In certain areas, it was noted that sediment delivery was somewhat limited by spoil banks and/or natural levees. Two areas (Subareas 1 and 2) were identified as potential sites to promote marsh building by constructing artificial crevasses through spoil banks and natural levees (Figure 3). A total of seven sites (Figures 4 and 5) were identified which provided favorable conditions for crevasse construction and splay development. Each site is adjacent to a distributary channel (i.e., canal or bayou) of the Mississippi River, contains shallow open water, and provides an outlet for freshwater flow. The receiving areas for the crevasses consist of shallow open water habitat which should begin to fill rapidly, resulting in the establishment of emergent marsh.

Because of the large size of the open water area at crevasse 1A (Figure 4), terraces will be constructed to directly establish marsh, promote the settlement of suspended sediment, reduce fetch in the open water area, and provide areas of low-energy for the establishment of submerged aquatic vegetation. The terraces are aligned northeast-southwest to reduce wave erosion in adjacent marshes from prevailing southeasterly winds. The terraces will be planted with the appropriate plant species to insure rapid colonization.

Originally, one crevasse (2A) was proposed for the northernmost receiving area in Subarea 2 (Figure 5). That crevasse was to be constructed off of the same canal as crevasses 2B and 2C.

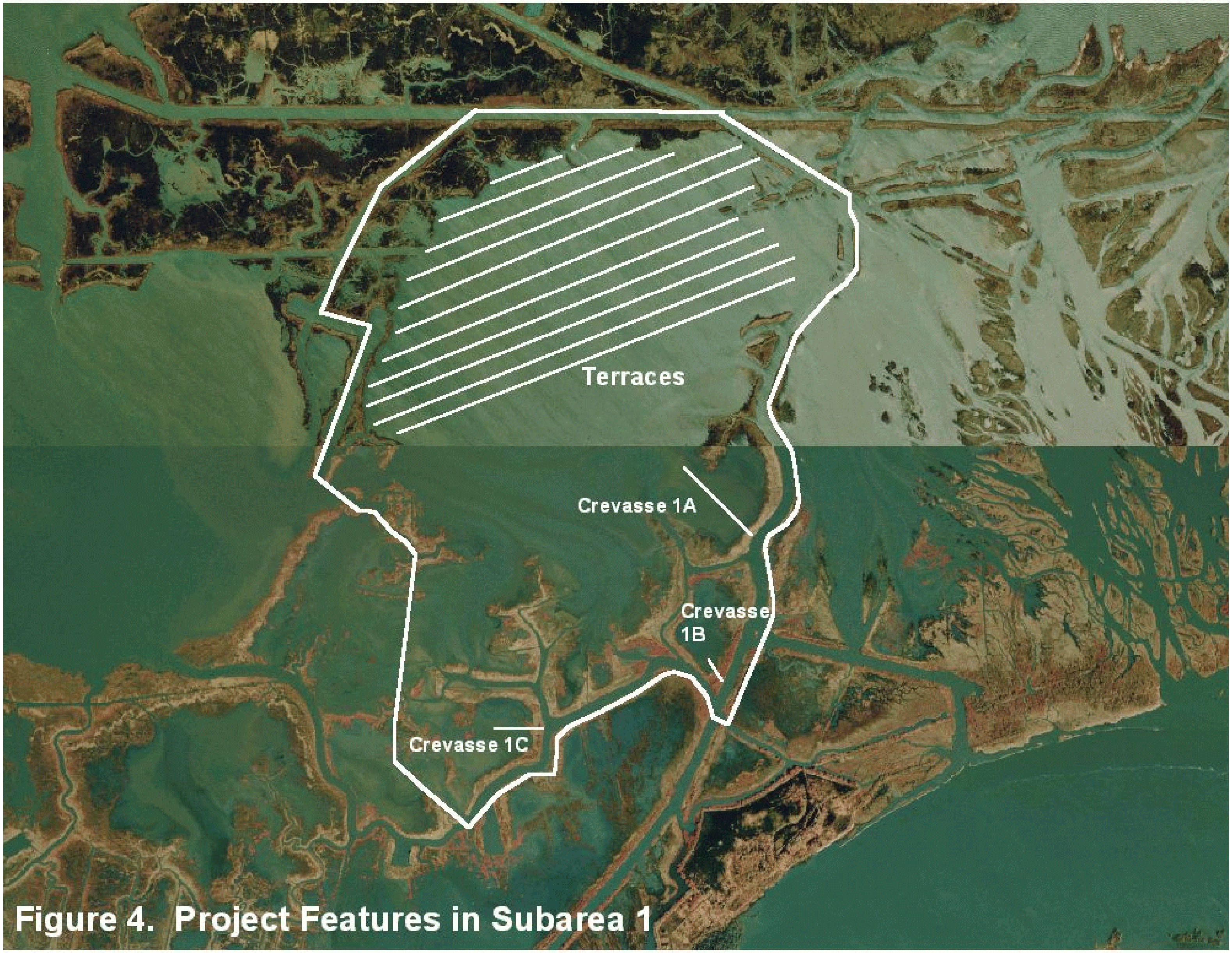


Figure 4.  Project Features in Subarea 1


Figure 5.  Project Features in Subarea 2

However, a pipeline located along the northern bank of that canal prevented construction of crevasse 2A as originally proposed. Therefore, an alternate site for 2A was selected (i.e., Alternate 2A) and an additional crevasse (2D) was planned to ensure adequate flow into the receiving area.

The authorized life for a CWPPRA project is 20 years. As evidenced by other projects, the crevasses will begin to infill during the project life, reducing their ability to transport sediment into the receiving area. Therefore, to ensure that the crevasses function throughout the project life, the preferred alternative also includes two maintenance dredging events. It is assumed that two maintenance events will be adequate to ensure that the crevasses continue to function throughout the project life. The preferred alternative also includes monitoring 1 year before project construction and for 19 years after project construction.

The locations of all project features are shown on Figures 4 and 5; Appendix A contains detailed drawings of all project features. Project features include:

1. Seven crevasses to facilitate the flow of fresh water and sediments into open water. Crevasse dimensions (width, length, and depth) are as follows:

| **Crevasse** | **Length (feet)** | **Width (feet)** | **Depth (feet)** |
|---|---|---|---|
| 1A | 2,000 | 75 | 8 |
| 1B | 400 | 75 | 6 |
| 1C | 700 | 75 | 6 |
| Alternate 2A | 625 | 75 | 8 |
| 2B | 900 | 75 | 8 |
| 2C | 1,500 | 75 | 8 |
| 2D | 500 | 75 | 8 |

2. A total of 164 terraces (32,800 linear feet) will be constructed in 11 staggered rows across the northern half of Subarea 1 and oriented northeast-southwest. The terraces will be 200 feet long with gaps 50 feet wide between the terraces; the rows will be 200 feet apart. The terraces will be constructed to a top width of 10 feet, 6:1 side slopes, and an elevation of 3.5 feet NAVD88 (see Appendix A for detailed drawings). The terraces will be constructed in approximately 1.5 feet of water. The terraces will be planted with two rows of seashore paspalum on the top and two rows of saltmarsh cordgrass on each side.

3. All project features will be constructed with a barge-mounted bucket dredge. Borrow areas for the terraces will parallel each terrace row. Disposal areas for the crevasses will be located on each side of the crevasse and will result in disposal of dredged material in open water (19.8 acres) and on emergent marsh (3.6 acres). Disposal in open water is anticipated to create 19.8 acres of emergent marsh while disposal on emergent marsh is anticipated to create non-wetland (i.e., scrub/shrub) habitat. Construction of the crevasses will also result in the direct removal of 1.8 acres of emergent marsh.

# SECTION 3.0 AFFECTED ENVIRONMENT

## SECTION 3.1 PHYSICAL ENVIRONMENT

### A. Regional Hydrology

The project area is located on the east side of the Mississippi River at mile 19.5 Above Head of Passes. The Mississippi River discharges flows from approximately 41 percent of the contiguous 48 states. Discharges in the river average 470,000 cubic feet per second (cfs). Average annual high and low discharges are 1,050,000 cfs and 161,000 cfs, respectively. Mississippi River stages at Venice, Louisiana, average 2.4 feet NGVD with an average annual high of 5.0 feet NGVD and average annual low of 0.3 foot NGVD. The Mississippi River Ship Channel, Louisiana, Project authorized the enlargement of the Mississippi River to a project depth of 55 feet between Baton Rouge and the Gulf of Mexico, however, the current navigation channel is maintained at 45 feet (LCWCRTF 1993*b*). Mississippi River depths in the vicinity of the project area exceed 160 feet in some locations (U.S. Army Corps of Engineers 1988). River flows are confined within flood protection levees on each side of the river for most of its length. Flood protection levees extend down to Venice on the west side of the river and to Bohemia on the east side of the river (approximately 25 miles upstream of the project area). Downstream from Bohemia, river flows escape the channel through several natural and man-made openings in the river bank such as those located near Fort St. Philip (Figure 6).

Suspended sediment in the Mississippi River has been monitored since 1949. Suspended sediment concentrations decreased significantly from 1950 to 1966, but minimally since that time. In 1951, suspended sediment loads averaged 1,576,000 tons per day and currently average 436,000 tons per day (LCWCRTF 1993*b*). Large quantities of sediment are dredged from the Mississippi River each year as part of the Corps' maintenance of the Mississippi River navigation channel. Large amounts of sediment are also lost to the Gulf of Mexico as Mississippi River flows reach the deep open waters of the continental shelf.

### B. Subareas Affected

Two subareas have been identified which will be affected by the project (Figure 3). Subarea 1 is the westernmost area and consists of 174 acres of emergent marsh and 678 acres of open water. It is located east of Bay Denesse, north of Fort Bayou, west of Bayou Plaquemines, and south of an east-west pipeline canal. Subarea 2 consists of 126 acres of emergent marsh and 327 acres of open water. It is located between Little Coquille Bay and the Mississippi River.

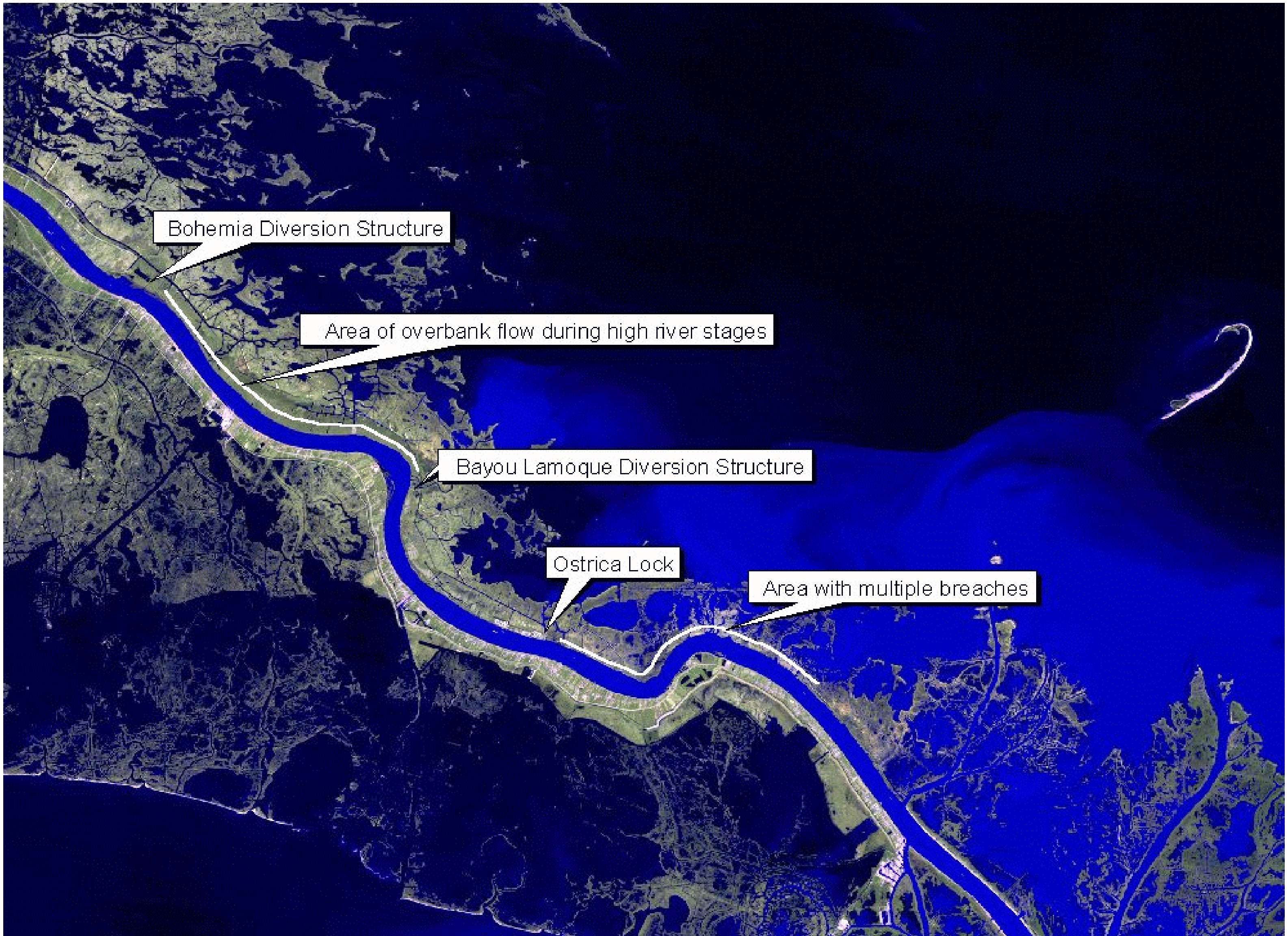


**Figure 6. Locations of Openings in the East Bank of the Mississippi River**

### C. Local Hydrology

The local hydrology is dominated by Mississippi River flows which enter the project area through several natural and man-made openings in the river bank. The project area is tidally influenced and experiences extreme events which expose large expanses of mudflats and other intertidal habitats. Marine processes in Breton Sound, winds, and the passage of frontal systems also influence the hydrology of the project area.

A rock dike parallels the east bank of the Mississippi River in the vicinity of the project area. Several breaches through the dike, as well as its low elevation, allow continuous flow of river water into the project area. River flow enters Subarea 1 through an oilfield access canal which intersects Bayou Plaquemines and Fort Bayou. Freshwater flows are well-distributed throughout the area through small bayous, canals, channels, and breaches through spoil banks and low natural ridges. Small deltaic splays have formed in many open water areas where flow velocities are reduced and sedimentation occurs. However, river flow is restricted in some areas, except during high river stages, by spoil banks and low natural ridges.

Mississippi River flow enters Subarea 2 via the Southern Natural Gas pipeline canal which runs from the river to Grand Coquille Bay. Flow exits the canal through spoil bank breaches and other openings into the adjacent wetlands along the canal length.

### D. Water Quality

As part of its surface water quality monitoring program, the Louisiana Department of Environmental Quality (LDEQ) routinely monitors 25 parameters on a monthly or bimonthly basis using a fixed station, long-term network (LDEQ 1996). Based upon those data (i.e., Monitored Assessments) and the use of less-continuous information, such as fish tissue contaminants data, complaint investigations and spill reports (i.e., Evaluated Assessments), the LDEQ has assessed water quality fitness for the following uses: primary contact recreation (swimming), secondary contact recreation (boating, fishing), fish and wildlife propagation, drinking water supply and shellfish propagation (LDEQ 1996). Based upon existing data and more subjective information, water quality is determined to either fully, partially, or, not support those uses. A designation of "threatened" is used for waters that fully support their designated uses but that may not fully support certain uses in the future because of anticipated sources or adverse trends in pollution.

No established surface water quality monitoring stations exist within or near the project area. The nearest water quality monitoring station is in the Mississippi River near Point a la Hache, approximately 30 miles upstream from the project area. That station and three other stations are used, along with less continuous information, to assess water quality in the Mississippi River from Monte Sano Bayou, near Baton Rouge, to Head of Passes. Table 1 provides a summary of the Monitored and Evaluative Assessments for that segment of the Mississippi River.

Less continuous information (i.e., Evaluative Assessment) is also available for Baptiste Collette Bayou, which should exhibit water quality conditions similar to those in the project area. Baptiste Collette Bayou is a distributary of the Mississippi River and is located approximately 8 river miles downstream from the project area. Similar to Baptiste Collette Bayou, the various waterways dissecting the project area also serve as Mississippi River distributaries. Table 1 provides a summary of the Evaluative Assessments for Baptiste Collette Bayou.

Table 1. Combined Monitored and Evaluative Assessments of water quality for water bodies near the project area (LDEQ 1996).

| Water Body Subsegment Code | Location Description | Overall Degree of Support | Primary Contact Recreation | Secondary Contact Recreation | Fish and Wildlife Propagation |
|---|---|---|---|---|---|
| 070301 | Mississippi River - from Monte Sano Bayou to Head of Passes | Partial | Not Supporting | Not Supporting | Full |
| 070402 | Baptiste Collette Bayou (estuarine) | Full | Full | Full | Full |

## SECTION 3.2 BIOLOGICAL ENVIRONMENT

### A. Vegetation

In 1949, Subarea 1 was classified as approximately 20 percent brackish marsh and 80 percent saline marsh and Subarea 2 was classified as approximately 50 percent brackish and 50 percent saline (O'Neil 1949). Both subareas were classified as saline marsh in 1968 (Chabreck and Linscombe 1968). In 1978, Subarea 1 was classified as saline and Subarea 2 was approximately 10 percent intermediate, 20 percent brackish and 70 percent saline (Chabreck and Linscombe 1978). On the 1978 Vegetative Type Map, a prominent lobe of intermediate marsh is shown between Subareas 1 and 2, clearly indicating the effects of the crevasse which formed in 1973. In 1988, Subarea 1 was classified as approximately 10 percent brackish marsh and 90 percent saline marsh and Subarea 2 was 10 percent intermediate, 60 percent brackish and 30 percent saline (Chabreck and Linscombe 1988). The 1997 Vegetative Type Map classifies both subareas as intermediate (Chabreck and Linscombe 1997).

Vegetative communities are very diverse in the project area. Typically, fresher communities are found near the river with a gradation to saline marsh toward Breton Sound. Species common to all four marsh types are found in many areas. Emergent marsh species include elephant's ear, common reed, bulltongue, alligatorweed, delta duckpotato, soft rush, black needlerush, smartweed, Walter's millet, saltmeadow cordgrass, saltmarsh cordgrass, freshwater threesquare, Olney bulrush, saltmarsh bulrush, torpedograss, giant cutgrass, deerpea, and cattail. Spoil banks and natural ridges include black willow, rattlebox, eastern baccharis, elephant's ear, deerpea, and common reed. Submerged and floating-leaved species include Eurasian milfoil, southern naiad, sago pondweed, curley-leaf pondweed, big pondweed, and water stargrass.

### B. Fisheries

The project area supports a diverse assemblage of fishes and shellfishes because of its proximity to the Mississippi River and Breton Sound. Freshwater inflow from the Mississippi River often results in fresh conditions in the project area during high river stages; higher salinities occur during low river stages and greater marine influence from Breton Sound. During low-salinity periods, the project area may be utilized by estuarine-dependent species tolerant of low salinities, such as Gulf menhaden, blue crab, white shrimp, Atlantic croaker and striped mullet. Species present during high-salinity periods probably include species more typical of brackish marsh habitat and include red drum, sand seatrout, spotted seatrout, black drum, Atlantic croaker, spot, sheepshead, southern flounder, brown shrimp and others. Wetlands throughout the project area support small resident fishes and shellfish such as least killifish, sheepshead minnow, mosquitofish, sailfin molly, grass shrimp and others. Those species are typically found along marsh edges or among submerged vegetation, and provide forage for a variety of fish and wildlife.

**C. Essential Fish Habitat**

Project features are located within an area identified as Essential Fish Habitat (EFH) by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). The 1998 generic amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the Gulf of Mexico Fishery Management Council identifies EFH in the project area to be estuarine emergent wetlands, submerged aquatic vegetation, estuarine water column, and mud, sand, shell, and rock substrates. Under the MSFCMA, wetlands and associated estuarine waters in the project area are identified as EFH for postlarval/juvenile and subadult brown shrimp; postlarval/juvenile and subadult white shrimp; and postlarval/juvenile, subadult, and adult red drum. Table 2 provides a more detailed description of EFH within the project area.

Table 2. EFH Requirements for Managed Species that Occur in the Project Area.

| Species | Life Stage | Essential Fish Habitat | Occurrence in Project Area |
|---|---|---|---|
| Brown shrimp | postlarval/juvenile | marsh edge, SAV, tidal creeks, inner marsh | All habitats are found throughout the project area |
| | subadult | mud bottoms, marsh edge | All habitats are found throughout the project area |
| White shrimp | postlarval/juvenile subadult | marsh edge, SAV, marsh ponds, inner marsh, oyster reefs | All habitats are found throughout the project area (excluding oyster reefs) |
| Red drum | postlarval/juvenile | SAV, estuarine mud bottoms, marsh/water interface | All habitats are found throughout the project area |
| | subadult | mud bottoms, oyster reefs | Mud bottoms are found within open water areas |
| | adult | Gulf of Mexico & estuarine mud bottoms, oyster reefs | Estuarine mud bottoms are found within open water areas |

**D. Wildlife**

The project area provides important habitat for several species of wildlife, including waterfowl, wading birds, shorebirds, mammals, reptiles and amphibians. The project area provides wintering habitat for migratory puddle ducks including mallard, gadwall, northern pintail, blue-winged teal, green-winged teal, American widgeon, and northern shoveler. Several diving duck species also utilize the project area, including lesser scaup, redhead, canvasback, and ring-necked duck. The resident mottled duck, which nests in fresh to brackish marshes along the coast, is found throughout the year.

Common wading bird species which utilize the project area include the great blue heron, little blue heron, green heron, tricolored heron, great egret, snowy egret, cattle egret, yellow-crowned night-heron, black-crowned night-heron, glossy ibis, and white ibis. Mudflats and shallow-water areas provide habitat for numerous species of shorebirds and seabirds. Shorebirds include the killdeer, American avocet, willet, black-necked stilt, dowitchers, common snipe, and various species of sandpipers. Seabirds include the white pelican, black skimmer, herring gull, laughing gull, and several species of terns.

Other common bird species found in the project area include boat-tailed grackle, red-winged blackbird, seaside sparrow, northern harrier, belted kingfisher, and marsh wrens. Besides migratory waterfowl, other game birds which occur within the area include the king rail, clapper rail, sora, Virginia rail, American coot, and common snipe.

Common mammals occurring in the project area include nutria, muskrat, mink, river otter, and raccoon.

Reptiles and amphibians are common in fresh and low-salinity marshes. Reptiles include the American alligator, western cottonmouth, water snakes, mud snake, speckled kingsnake, rat snake, red-eared slider, and eastern mud turtle. Amphibians expected to occur in the area include the bullfrog, pig frog, bronze frog, leopard frog, cricket frogs, three-toed amphiuma, sirens, and Gulf coast toad.

**E. Threatened and Endangered Species**

Endangered brown pelicans (*Pelecanus occidentalis*) may occur within the project area. No known brown pelican colony locations occur within the project area; however, this species may feed in the shallow estuarine waters, as well as use sand bars as rest and roost areas in this area. Major threats to this species include chemical pollutants, colony site erosion, disease, and human disturbance.

## SECTION 3.3 CULTURAL AND RECREATIONAL RESOURCES

Various cultural resources occur throughout the Louisiana coastal zone, including both prehistoric and historic sites. The Louisiana Department of Culture, Recreation and Tourism maintains catalogues of numerous cultural resource sites, but many areas remain unsurveyed and the significance or eligibility of some sites for inclusion in the National Register of Historic Places has not been determined. A review by the Louisiana Office of Cultural Development, Division of Archeology indicates that there is one archeological site, Fort St. Philip, located within the area of potential project effects.

Recreational use of the project area is oriented primarily toward hunting, fishing, and crabbing. Access to the project area is by boat only as no roads or highways are present. Boat access is provided by boat launches and marinas on the western side of the Mississippi River. One unimproved public boat launch is located at Fort Jackson directly across the river from the project area. Several improved boat launches and marinas are located downstream of the project area in Venice.

### SECTION 3.4 ECONOMIC RESOURCES

Coastal wetlands like those within the project area provide essential nursery habitat for commercially and recreationally important fishes and shellfishes such as Gulf menhaden, red drum, spotted seatrout, southern flounder, brown shrimp, white shrimp, blue crab and others. National Marine Fisheries Service statistics for the last 20 years indicate that coastal Louisiana contributes approximately 20 percent of the nation's total commercial fisheries harvest (LCWCRTF and WCRA 1998*a*). The total economic value of Louisiana's commercial fishery landings approaches $1 billion annually. Shrimp, oyster, blue crab and Gulf menhaden account for 98 percent of that value. Additionally, Louisiana's shrimp and oyster harvests comprise approximately 35 to 40 percent of the national total for those species (LCWCRTF 1993*a*).
Louisiana's coastal wetlands also produce more wild furs than any other state in the nation. Recreational fishing in Louisiana's coastal marshes has an estimated annual economic impact of $500 million (LCWCRTF 1993*a*). Coastal marshes also provide substantial economic value associated with waterfowl hunting.

Six natural gas/oil pipelines occur in the project area as well as several inactive wells (USGS/LDNR GIS database, Map ID:2001-4-604). There is also a network of access canals used by oil and gas companies to service wells in and around the project area. Those canals are also used by commercial and recreational fishermen and hunters to access the project area and surrounding marshes.

## SECTION 4.0 ENVIRONMENTAL CONSEQUENCES

### SECTION 4.1 ALTERNATIVE 1 - NO ACTION

**A. Physical Environment**

**Regional Hydrology**
Under the No Action Alternative, no changes to the regional hydrology are expected. Flow from the Mississippi River will continue to provide fresh water, sediments and nutrients to the project area. Impacts to the regional hydrology could occur as a result of modifications to the Mississippi River navigation channel, formation of a large crevasse along the Mississippi River, or other events of that magnitude. Such actions are beyond the scope of this Environmental Assessment.

**Subareas Affected**
Under the No Action Alternative, Subareas 1 and 2 would continue to receive fresh water, sediments and nutrients from the Mississippi River. The October 3, 2000, Wetland Value Assessment (WVA) prepared by the CWPPRA Environmental Work Group projected that 174 acres of emergent marsh

would develop from the ongoing marsh-building processes occurring in the project area. The volume of flow into those areas, however, would continue to be restricted by spoil banks and low natural levees, reducing the potential for higher rates of emergent marsh creation. Significant flow into those areas would mainly occur during high river stages and flow would remain channelized during low river stages, bypassing those areas.

**Local Hydrology**
Under the No Action Alternative, the local hydrology in the project area would not be impacted. Fresh water will continue to flow from the Mississippi River into the project area through the numerous breaches in the river bank and rock dike which parallel the river. The bayous and canals which dissect the project area will continue to be dominated by flows from the Mississippi River and be influenced by marine processes from Breton Sound.

Major impacts to the local hydrology would occur if the rock dike along the bank of the Mississippi River was altered to restrict river flow into the project area. However, the Corps of Engineers has indicated that no such modifications to the rock dike are scheduled (pers. comm. Don Rawson, Corps of Engineers).

**Water Quality**
Water quality in the project area is primarily influenced by the Mississippi River which provides continuous flow into the project area. Under the No Action Alternative, water quality in the project area is not likely to change unless the influence of the Mississippi River is altered or water quality within the river itself changes. Mississippi River influence in the project area could be impacted by modifications to the river itself, or to the rock dike along the east bank of the river. Permanent modifications to the rock dike along the river bank by the Corps of Engineers are not expected to occur. Modifications to the Mississippi River navigation channel are beyond the scope of this Environmental Assessment.

## B. Biological Environment

**Vegetation**
Under the No Action Alternative, vegetative communities will remain very similar to those currently found in the project area. Fresh water and sediments will continue to flow into the project area from the Mississippi River via breaches in the river bank and the network of bayous and canals in the area. The introduction of sediment will allow marsh-building processes to continue, resulting in the conversion of open water to emergent habitat. Fresh conditions provided by the influence of Mississippi River water will also result in a diverse community of submerged and floating-leaved aquatic species. However, marsh growth will continue to be impaired by the spoil banks and natural levees which limit freshwater flow into the project area.

**Fisheries**
Under the No Action Alternative, the project area will continue to support a diverse assemblage of fishery species. Proximity to the Mississippi River to the south and Breton Sound to the north will continue to result in variable salinity conditions in the project area. Those conditions will continue to provide suitable habitat for species tolerant of low salinities (e.g., blue crab, Gulf menhaden, red drum) and, during low flow periods, those adapted to higher salinities (e.g., brown shrimp, spotted seatrout).

**Essential Fish Habitat Assessment**

Under the No Action Alternative, natural marsh-building processes will continue to occur in the project area as a result of continued sediment input from the Mississippi River. Estuarine emergent wetlands and SAV are the primary types of EFH that would increase under this alternative. According to the October 3, 2000, Wetland Value Assessment conducted by the CWPPRA Environmental Work Group, 174 acres of emergent marsh would develop in the project area and SAV would increase by 52 percent under the No Action Alternative. Increased estuarine emergent wetlands and SAV would benefit postlarval/juvenile and subadult brown shrimp; postlarval/juvenile and subadult white shrimp; and postlarval/juvenile red drum.

Formation of additional estuarine emergent wetlands would result in the loss of mud bottoms and estuarine water column as emergent marsh would replace those habitats. That process would result in minor negative impacts to subadult brown shrimp and postlarval/juvenile, subadult, and adult red drum.

Although adverse impacts would occur to some types of EFH (i.e., mud bottom and estuarine water column), more productive types of EFH (i.e., estuarine emergent wetlands and SAV) would be created under the No Action Alternative. The formation of additional estuarine emergent wetlands and SAV would result in a net positive impact to all managed species that occur in the project area.

**Wildlife**

Under the No Action Alternative, the project area will continue to provide habitat for a multitude of species including migratory waterfowl, wading birds, shorebirds, mammals, reptiles, and amphibians. Because an increase in emergent marsh will result, even under the no action scenario, habitat conditions for those species will improve. However, the spoil banks and natural levees will continue to restrict marsh growth in the project area and, thus, limit emergent habitat for those species.

**Threatened and Endangered Species**

The endangered brown pelican may feed in the shallow estuarine waters of the project area, as well as use sand bars as resting and roosting areas. The potential for brown pelican use of the project area would continue under the No Action Alternative and could potentially increase with the development of sand bars/spits with continued sediment input from the Mississippi River.

## C. Cultural and Recreational Resources

One archeological site, Fort St. Philip, is located within the area of potential project effects. Fort St. Philip is located along the bank of the Mississippi River and would remain undisturbed under the No Action Alternative. Although recreational opportunities within the project area, such as hunting and birdwatching, may increase with the ongoing formation of emergent marsh, those opportunities would essentially be unaffected.

## D. Economic Resources

Waterfowl hunting and commercial and recreational fishing are important components of the local economy and occur within the project area. The continued formation of emergent marsh and beds of submerged aquatic vegetation could increase waterfowl hunting and fishing opportunities in the project area. The increased acreage of emergent wetlands could also act as a storm buffer for oil and gas facilities in the area.

## SECTION 4.2 ALTERNATIVE 2 - PREFERRED ALTERNATIVE

### A. Physical Environment

**Regional Hydrology**
Under the Preferred Alternative, no changes to the regional hydrology are expected to occur. Changes in the hydrology of the Mississippi River are not expected because project features do not include measures to increase the cross-sectional area of any openings along the east bank of the Mississippi River. Impacts to the regional hydrology could occur as a result of modifications to the Mississippi River navigation channel, formation of a large crevasse along the Mississippi River, or other events of that magnitude. Those events are beyond the scope of this Environmental Assessment.

**Subareas Affected**
Under the Preferred Alternative, the construction of artificial crevasses will direct the flow of fresh water, sediments and nutrients into Subareas 1 and 2. Compared to the No Action Alternative, those areas will receive greater volumes of suspended sediments, which will allow for the establishment of emergent marsh via natural marsh-building processes.

Terrace construction will initially create 16.5 acres of emergent marsh and an additional 8.5 acres will develop from expansion of the vegetative plantings. Dredged material from the crevasses will be used beneficially to create 19.8 acres of emergent marsh in open water. However, 5.4 acres of emergent marsh will be directly impacted by dredging of the crevasses and disposal of that material on emergent marsh.

The October 3, 2000, WVA completed by the CWPPRA Environmental Work Group predicted that the artificial crevasses would result in a net increase, compared to the No Action Alternative, 221 acres of emergent marsh. However, benefits projected by the Environmental Work Group are based on planning level design details. During the engineering and design of this project, a more rigorous evaluation of project benefits was conducted by the Louisiana Department of Natural Resources' Restoration Technology Section. Multiple and simple linear regression analyses were performed to determine the relationship between several crevasse parameters and the growth rate of emergent marsh in the project area (Louisiana Department of Natural Resources 2001). Data from Boyer (1996) and the Louisiana Department of Natural Resources (1993 and 1996) were used in the analysis. Crevasse parameters used to predict growth rates included parent channel order, parent channel width, crevasse age, crevasse cross-sectional area, and receiving bay area. R-squared values from those analyses ranged from 29 percent to 53 percent, indicating that other parameters, not included in those analyses, are also important in determining crevasse growth rates. From those analyses, growth rates predicted for the 20-year project life ranged from 652 acres (r-squared = 0.2899) to 235 acres (r-squared = 0.5284).

**Local Hydrology**
Under the Preferred Alternative, the project area will continue to be dominated by flows from the

Mississippi River and by marine processes from Breton Sound. Hydrologic conditions in the project area, however, will be impacted because crevasse construction will provide a direct conduit for the flow of fresh water and sediments into each receiving area. At present, direct freshwater flow into those receiving areas is somewhat restricted by spoil banks and low natural levees. Except during high tidal events or extremely low river stages, continuous freshwater flow should occur through each receiving area.

**Water Quality**
Water quality in the project area is primarily influenced by the Mississippi River, which provides continuous flow into the project area. Under the Preferred Alternative, water quality is not expected to be significantly impacted. During project construction, the dredging of crevasses and terrace construction will impact water quality by disturbing bottom sediments which will increase turbidity in open water areas. However, increased turbidity will only occur during construction, which is expected to last 4 months, and will dissipate rapidly upon project completion.

**B. Biological Environment**

**Vegetation**
Under the Preferred Alternative, vegetative communities are expected to change considerably as aquatic habitat is converted to emergent habitat with the formation of deltaic splays in each receiving area. White (1993) characterized vascular plant community development on deltaic splays in the Mississippi River delta. Four distinct communities consisting of 28 species were observed. After the emergence of mudflats, colonization is rapid and the plant community is dominated by annual grasses, sedges and other pioneer species. This pioneer community consists of species such as gooseweed, yellowseed falsepimpernel, purple ammania, Walter's millet, teal lovegrass, saltmarsh loosestrife, fall panicum, duck-potato, and several species of sedges. That community dominated the lower mudflats during the first two growing seasons.

By the third growing season, delta threesquare became the dominant plant species on the lower mudflats. Many of the species associated with the "pioneer" community were also present in the delta threesquare community. However, on the oldest lower mudflats, delta threesquare made up approximately 72 percent of the total biomass.

Spring floods often bring large pulses of suspended sediment onto deltaic splays and coarser sediments (i.e., those with higher sand and silt content) are often deposited on high mudflats and the upstream ends of deltaic islands. Those conditions provide an environment for the establishment of the black willow community. This community was found on mudflats more than four inches higher than the delta threesquare-dominated mudflats. Several species common to the pioneer and delta threesquare communities were also found on the black willow-dominated mudflats. However, the herbaceous layer formed by those species became more sparse with the development of a forested canopy.

White (1993) also observed another distinct vegetative community dominated by elephant's ear which was found at the lowest elevations of older islands. Other species present in this community included alligatorweed and pennywort. This community typically occupied quiet water areas highest in clay, silt, and organic material. Unlike the delta threesquare and black willow communities, the substrate in this community was usually covered with water except during extreme low water periods.

Vegetative colonization of developing splays in the project area is expected to follow the pattern reported by White (1993). Many of the species observed on splays in the Mississippi River delta are present within the project area and many of the same plant communities have been observed on splays adjacent to the project area. Although higher mudflats and natural levees are typically dominated by black willow, the lower mudflats can develop atypically as a result of unusual hydrologic, seeding, or herbivory events. Many mudflats emerge during the first growing season with a fully developed delta threesquare community while others vegetate very slowly and consist of the pioneer community for several growing seasons.

Submerged and floating-leaved species are expected to be the same as those currently found in the project area. Those species include Eurasian milfoil, southern naiad, sago pondweed, curley-leaf pondweed, big pondweed, and water stargrass. The terraces will reduce the fetch and create areas of calm water so that submerged and floating-leaved plant communities will cover a broader area than under the No Action Alternative. The October 3, 2000, Wetland Value Assessment indicates that submerged aquatic vegetation is projected to increase by 75 percent in Subarea 1 and by 67 percent in Subarea 2.

**Fisheries**

Under the Preferred Alternative, an increase in fish and shellfish habitat will result from the construction of terraces and the formation of deltaic splays. A recent study on the Atchafalaya Delta indicated that vegetated habitats (i.e., emergent marsh and submerged aquatic vegetation beds) generally supported much higher densities of fish and crustaceans than unvegetated habitat (Castellanos and Rozas 2001). Those habitats provide an important nursery function for several species. Crevasse construction is expected to result in the formation of habitats similar to those found on the Atchafalaya Delta and those found on the Mississippi River delta (White 1993). Compared to the No Action Alternative, an additional 267 acres of emergent marsh will result from project implementation. Much of that habitat will exist within the intertidal zone and will provide foraging and nursery habitat for several estuarine species. Furthermore, the tops and side slopes of the terraces will be planted with the appropriate vegetation to ensure rapid colonization. The intertidal zone along the terrace edges is expected to vegetate rapidly and will provide approximately 32,800 linear feet of marsh edge habitat. Coverage of submerged and floating-leaved aquatic vegetation will also increase in the project area.

Under the Preferred Alternative, the project area will continue to support a diverse assemblage of fishes and shellfishes. Proximity to the Mississippi River to the south and Breton Sound to the north will continue to result in variable salinity conditions in the project area. Those conditions will continue to provide suitable habitat for species tolerant of low salinities (e.g., blue crab, Gulf menhaden) and those more adapted to higher salinities (e.g., brown shrimp, spotted seatrout).

**Essential Fish Habitat Assessment**

Under the Preferred Alternative, natural marsh-building processes in the project area will be enhanced by the dredging of artificial crevasses and construction of earthen terraces. Estuarine emergent wetlands and SAV are the primary types of EFH that would increase significantly under this alternative. According to the October 3, 2000, Wetland Value Assessment, 441 acres of emergent marsh would develop under the Preferred Alternative compared to 174 acres under the No Action Alternative. Submerged aquatic vegetation would increase by 71 percent under the Preferred Alternative compared to 52 percent under the No Action Alternative. Increases in those habitat types would benefit postlarval/juvenile and subadult brown shrimp; postlarval/juvenile and subadult white shrimp; and postlarval/juvenile red drum.

The creation of estuarine emergent wetlands by the construction of earthen terraces would result in the loss of mud bottom and estuarine water column as emergent marsh would replace those habitat types. Construction of the earthen terraces, and subsequent expansion, would result in the conversion of 25 acres of mud bottom and estuarine water column to estuarine emergent wetlands. In addition, minor impacts would result to 7 acres (i.e., subaqueous portion of the terraces) of mud bottom and estuarine water column. Borrow areas for the terraces would result in minor impacts to 18 acres of mud bottom, however, the borrow areas are anticipated to fill in over time to pre-project depths. Loss of mud bottom EFH could result in negative impacts to subadult brown shrimp and postlarval/juvenile, subadult, and adult red drum.

The construction of the artificial crevasses and natural marsh-building processes in the area are expected to result in the formation of 416 acres (i.e., natural formation of marsh and creation via beneficial use of the dredged material) of estuarine emergent wetlands which would result in the loss of mud bottoms and estuarine water column. In addition, 10 acres of mud bottom (i.e., crevasse footprint) would be impacted by the dredging of the artificial crevasses. Furthermore, 5.4 acres of estuarine emergent wetlands would be dredged and filled with material from the crevasses. Loss of mud bottom EFH could result in negative impacts to subadult brown shrimp and postlarval/juvenile, subadult, and adult red drum. The loss of 5.4 acres estuarine emergent wetlands would result in minor negative impacts to postlarval/juvenile and subadult brown shrimp; postlarval/juvenile and subadult white shrimp; and postlarval/juvenile red drum.

Although adverse impacts would occur to some types of EFH (i.e., mud bottom and estuarine water column), more productive types of EFH (i.e., estuarine emergent wetlands and SAV) would be created under the Preferred Alternative. The loss of 5.4 acres of estuarine emergent wetlands would be compensated for by the creation of 441 acres of estuarine emergent wetlands within the project area. Therefore, the Preferred Alternative would result in a net positive benefit to all managed species that occur in the project area.

**Wildlife**

The Preferred Alternative will result in improved habitat conditions for several species of wildlife including migratory and resident waterfowl, shorebirds, wading birds, and furbearers. Migratory waterfowl utilizing the project area will benefit from a greater food supply resulting from the increased abundance of emergent, submerged, and floating-leaved species. The seeds and tubers of many of the emergent plant species expected in the project area will provide an important food source for several migratory species including mallard, pintail, blue-winged teal, and green-winged teal. Important plant species include Walter's millet, arrowheads, fall panicum, and several species of sedges and rushes. Several of the submerged and floating-leaved aquatic species expected in the project area (e.g., Eurasian watermilfoil, pondweeds, and southern naiad) are important food sources for gadwall, American wigeon, and northern shovelers which primarily feed on leafy aquatic vegetation (Chabreck et al. 1989). Canvasbacks which utilize deltaic splay habitat feed almost exclusively on the tubers of arrowheads and the rhizomes and seeds of delta threesquare (Hohman et al. 1990).

Habitat for the resident mottled duck will also improve considerably as the terraces will provide several acres of nesting habitat. Mottled ducks in the Atchafalaya Delta preferred nesting on sites above intertidal elevations with moderate shrub cover and avoided marsh sites which periodically flooded (Holbrook 1997). Currently, non-flooded nesting habitat is scarce within the project area. The terraces will also provide calm areas which are preferred for resting and loafing activities (Chabreck et al. 1989). Furthermore, higher-elevation mudflats which form and are colonized by black willow and other woody species may also provide suitable nesting sites. The remaining spoil banks and natural levees will continue to provide nesting habitat for mottled ducks as well as woody habitat for neotropical songbirds which migrate through or nest in the area.

Mudflats, intertidal marsh, and marsh edge habitat will also provide increased foraging opportunities for shorebirds and wading birds. Marsh edges and submerged aquatic vegetation beds will provide a greater diversity of prey items for wading birds such as the great blue heron, little blue heron, great egret, black-crowned night-heron, and snowy egret. Vegetated habitats often contain higher densities of fishes and crustaceans, important food items for wading birds, than unvegetated habitats (Castellanos and Rozas 2001). Mudflats created by deltaic splay formation will provide increased foraging opportunities for shorebirds such as least sandpipers, killdeer, and the American avocet. Those species feed on tiny invertebrates and crustaceans found on mudflats which are exposed at low tide.

Furbearers such as the nutria and muskrat, which feed on vegetation, will benefit from the increased marsh acreage in the project area. Furbearers such as the mink, river otter, and raccoon have a diverse diet and feed on many different species of fishes and crustaceans. Those species often feed along vegetated shorelines which provide cover for many of their prey species.

Generally, all wildlife species will benefit by habitat conditions resulting from the Preferred Alternative. An increase in emergent marsh, mudflats, and submerged and floating-leaved aquatic vegetation will provide greater opportunities for feeding, nesting, and resting activities.

**Threatened and Endangered Species**

The Preferred Alternative will have minimal impacts on brown pelicans within the project area. The endangered brown pelican may feed in the shallow estuarine waters of the project area, as well as use sand bars as resting and roosting areas. The potential for brown pelican use of the project area could potentially increase with the formation of sand bars/spits resulting from the artificial crevasses. Any displacement of brown pelicans during project construction would be temporary because of the immense amount of habitat in the vicinity of the project suitable for relocation.

## C. Cultural and Recreational Resources

One archeological site, Fort St. Philip, is located within the area of potential project effects. Fort St. Philip is located along the bank of the Mississippi River and would remain undisturbed under the Preferred Alternative. Activities associated with project construction will not impact the Fort St. Philip site. By letter dated January 17, 2002, the Louisiana Department of Culture, Recreation and Tourism indicated that the Preferred Alternative will have no effect on Fort St. Philip.

Recreational opportunities within the project area, such as hunting and birdwatching, may increase with the increased formation of emergent marsh, mudflats, and other fish and wildlife habitats. An increase in fish and wildlife usage may increase the recreational usage of the project area.

**D. Economic Resources**
By increasing wetland gain and fish and wildlife resources in the project area, the Preferred Alternative would help to maintain that portion of the local economy dependent on recreational and commercial fish and wildlife resources. Waterfowl hunting and commercial and recreational fishing are important components of the local economy which occur within and around the project area. The increased formation of emergent marsh and other fish and wildlife habitats could increase waterfowl hunting and fishing opportunities. The increased acreage of emergent wetlands could also act as a storm buffer for oil and gas facilities in the area.

## SECTION 5.0 DISCUSSION OF ALTERNATIVES

Concern was expressed as to whether or not soil conditions in the project area would support the construction of terraces. Concerns included the stackability of the material and the ability of the soil substrate to support terraces. A geotechnical analysis performed on soil borings taken in the project area provided evidence soil conditions will allow the construction of terraces. Furthermore, the presence of older spoil banks in the project area (i.e., greater than 20 years old) would seem to indicate that terraces can be constructed to last throughout the project life.

## SECTION 6.0 RATIONALE FOR SELECTING PREFERRED ALTERNATIVE

Crevasse formation is a natural process which occurs during the development of deltaic wetlands and was once a common event along the Mississippi River and its distributaries (Davis 1993). However, flood protection levees along the Mississippi River have restricted crevasse formation to the unleveed portion of the river downstream of Bohemia and to the Mississippi River delta where natural crevasse formation still occurs. A crevasse forms as floodwaters rise in a distributary channel, the natural levee is overtopped, and the flowing water cuts a breach or opening in the channel bank and allows water to flow into the adjacent receiving area. Water flowing through the breach carries sediments into the receiving bay. Sediment deposition occurs as flood waters are spread over the receiving area and velocities are reduced. As sedimentation continues during subsequent years, subaerial growth occurs and emergent land is colonized by vegetation. Gosselink (1984) provides an excellent description of crevasse formation and the ensuing cycle of sedimentation, marsh development, crevasse closure, and abandonment.

The construction of artificial crevasses has been recognized as a cost-effective technique for creating emergent wetlands (Turner 1990), and their success has been well documented (Boyer 1996, Trepagnier 1994, Louisiana Department of Natural Resources 1993, 1996). Artificial crevasses have been successful in creating emergent wetlands at a number of sites on Delta National Wildlife Refuge and Pass a Loutre Wildlife Management Area. The ability of a crevasse to create emergent wetlands depends on a number of factors: 1) distance from the Mississippi River, 2) parent channel and crevasse cross-sectional area, 3) crevasse depth and cut angle from parent channel, 4) receiving area size, 5) parent channel order, 6) crevasse age, and 7) outflow ability of the receiving area. Each of those factors were taken into consideration in designing this project and projecting its wetland benefits.

Multiple and simple linear regression analyses performed by the Louisiana Department of Natural Resources' Restoration Technology Section project growth rates ranging from 235 acres to 652 acres over the project life. Growth rates predicted from those analyses are very similar to the growth rates (i.e., 221 acres) predicted by the CWPPRA Environmental Work Group during initial project planning.

The Preferred Alternative is supported by the LCWCRTF, which approved funding for engineering and design on January 10, 2001 and subsequently approved for construction funds on August 7, 2002. The Preferred Alternative will increase the growth rate of emergent marsh in the project area and increase its habitat value for fish and wildlife resources. The Preferred Alternative also supports the restoration strategies recommended for this region in the Coast 2050 Plan. It is not anticipated that land rights issues will preclude construction of project features.

## SECTION 7.0 COMPATIBILITY WITH CWPPRA AND COMMUNITY OBJECTIVES

The Preferred Alternative would help to achieve CWPPRA objectives for protection and restoration of Louisiana's coastal wetlands. The cumulative impact of all CWPPRA projects approved to date would result in the protection/creation/restoration of approximately 103,000 acres of coastal wetlands. Cumulative impacts of the CWPPRA Program are addressed in the Louisiana Coastal Wetlands Restoration Plan Main Report and Environmental Impact Statement (1993).

Community objectives would likely be enhanced by the proposed project. Common socioeconomic goals include the conservation of sustainable fishing, shrimping, crabbing and hunting opportunities in the region. The general public also supports wetland restoration and preservation for fish and wildlife habitat, for recreational, aesthetic and other non-consumptive uses.

## SECTION 8.0 COMPLIANCE WITH LAWS, REGULATIONS AND POLICIES

This Environmental Assessment was prepared in compliance with the National Environmental Policy Act of 1969 (NEPA). It is consistent with the NEPA-compliance procedures contained in the Service's manual (550 FW 1-3), and employs a systematic, interdisciplinary approach. The proposed action involves disposal of fill material into waters or wetlands; therefore, an evaluation under Section 404(b)(1) of the Clean Water Act of 1977, as amended, is required, as well as state water quality certification under Section 401. A Clean Water Act Section 404 permit has been received from the U.S. Army Corps of Engineers as well as Water Quality Certification from the Louisiana Department of Environmental Quality.

Under the MSFCMA, the Service initiated consultation with the National Marine Fisheries Service upon submission of the draft Environmental Assessment and has evaluated project-related impacts to EFH within the project area. Although the Preferred Alternative would result in adverse impacts to some categories (i.e., mud bottom and estuarine water column) of EFH, more productive categories of EFH, such as estuarine emergent wetlands, would be created. Therefore, the Service finds that the Preferred Alternative would not result in net adverse impacts to habitats designated as EFH under the MSFCMA.

The proposed action is located within the Louisiana Coastal Zone, but involves no construction activities that would result in significant direct, indirect, or cumulative adverse impacts to coastal waters or wetlands. The Service has been granted a Consistency Determination from the Louisiana Coastal Resources Program. By letter dated September 11, 2002, the Louisiana Department of Natural Resources indicated that the Preferred Alternative is consistent with the Louisiana Coastal Resources Program.

By letter dated January 17, 2002, from the State Historic Preservation Officer, the project is compliant with the National Historic Preservation Act of 1966, as amended.

Pursuant to Executive Order 12898 (Environmental Justice for Minority Populations), the Service has determined that the Preferred Alternative will not result in disproportionately high and adverse human health or environmental impacts on minority and low-income populations.

Other Federal and state issues reviewed for compliance for the proposed action include, but are not limited to: the Endangered Species Act of 1973, as amended; Archeological and Historic Preservation Act of 1974; Executive Order 11988 (Floodplain Management); Executive Order 11990 (Protection of Wetlands); and Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds). Full compliance with relevant laws and regulations has been achieved with review of this Environmental Assessment by appropriate agencies and interested parties, and the signing of a Finding of No Significant Impact and Environmental Action Statement.

## SECTION 9.0 PREPARER

This Environmental Assessment was prepared by the Service, Ecological Services, Lafayette, Louisiana. The document was prepared by Kevin J. Roy, Senior Field Biologist.

## SECTION 10.0 LITERATURE CITED


Barras, J.A., P.E. Bourgeois, and L.R. Handley. 1994. Land loss in coastal Louisiana 1956-90. National Biological Survey, National Wetlands Research Center Open Report 94-01. 4 pp.

Boyer, M.E. 1996. Thesis: Constructed crevasses as a technique for land gain in the Mississippi River delta. Louisiana State University. Baton Rouge, LA. 110 pp.

Castellanos, D.L. and L. P. Rozas. 2001. Nekton use of submerged aquatic vegetation, marsh, and shallow unvegetated bottom in the Atchafalaya River delta, a Louisiana tidal freshwater ecosystem. Estuaries. Vol. 24, No. 2, p. 184-197.

Chabreck, R., T. Joanen, and S. L. Paulus. 1989. Southern Coastal Marshes and Lakes. Pages 249-277 *in* L.M. Smith, R.L. Pederson and R.M. Kaminski (eds.), Habitat Management for Migrating and Wintering Waterfowl in North America. Texas Tech University Press, Lubbock, TX.

Chabreck, R. and G. Linscombe. 1968. Vegetative Type Map of the Louisiana Coastal Marshes. Louisiana Department of Wildlife and Fisheries, New Orleans.

Chabreck, R. and G. Linscombe. 1978. Vegetative Type Map of the Louisiana Coastal Marshes. Louisiana Department of Wildlife and Fisheries, New Orleans.

Chabreck, R. and G. Linscombe. 1988. Vegetative Type Map of the Louisiana Coastal Marshes. Louisiana Department of Wildlife and Fisheries, Baton Rouge.

Chabreck, R. and G. Linscombe. 1997. Vegetative Type Map of the Louisiana Coastal Marshes. Louisiana Department of Wildlife and Fisheries, Baton Rouge.

Davis, D.W. 1993. Crevasses on the lower course of the Mississippi River. Pages 360-378 *in* O.T. Magoon, W.S. Wilson, H. Converse and L.T. Tobin (eds.), Coastal Zone '93. Proceedings of the Eighth Symposium on Coastal and Ocean Management. New York, NY.

Dunbar, J.B., L.D. Britsch and E.B. Kemp, III. 1992. Land Loss Rates, Report 3, Louisiana Coastal Plain. Technical Report GL-90-2. Vicksburg, MS.: U.S. Army Corps of Engineers, U.S. Waterways Experiment Station.

Gosselink, J.G. 1984. The ecology of delta marshes of coastal Louisiana: A community profile. U.S. Fish and Wildlife Service FWS/OBS-84/09. U.S.A. 134 pp.

Hohman, W.L., D.W. Woolington and J.H. Devries. 1990. Food habits of wintering canvasbacks in Louisiana. Canadian Journal of Zoology. Vol. 68 (No. 12):2605-2609.

Holbrook, R.S. 1997. Ecology of nesting mottled ducks at the Atchafalaya River Delta, Louisiana. Master's Thesis. Louisiana State University. School of Forestry, Wildlife, and Fisheries. Baton Rouge, LA.

Louisiana Coastal Marsh Vegetative Type Map (Database). 1997. Louisiana Department of Wildlife and Fisheries, Fur and Refuge Division, and the U. S. Geological Survey's National Wetlands Research Center, Lafayette, LA.

Louisiana Coastal Wetlands Conservation and Restoration Task Force. 1993. Louisiana Coastal Wetlands Restoration Plan, Main Report and Environmental Impact Statement.

Louisiana Coastal Wetlands Conservation and Restoration Task Force. 1993*a*. Louisiana Coastal Wetlands Restoration Plan, Main Report and Environmental Impact Statement. Appendix B, Breton Sound Basin. 46 pp.

Louisiana Coastal Wetlands Conservation and Restoration Task Force. 1993*b*. Louisiana Coastal Wetlands Restoration Plan, Main Report and Environmental Impact Statement. Appendix C, Mississippi River Delta Basin. 74 pp.

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1998*a*. Coast 2050: Toward a Sustainable Coastal Louisiana. Louisiana Department of Natural Resources. Baton Rouge, LA. 161 pp.

Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority. 1998*b*. Coast 2050: Toward a Sustainable Coastal Louisiana. Appendix D. Louisiana Department of Natural Resources. Baton Rouge, La. 170 pp.

Louisiana Department of Environmental Quality. 1996. State of Louisiana Water Quality Management Plan, Water Quality Inventory. Appendices A and B. Baton Rouge, LA.

Louisiana Department of Environmental Quality. 1998. Louisiana Environmental Regulatory Code: Louisiana Water Quality Regulations. Title 33. Part IX, Chapter 11. Water Quality Management Division. Baton Rouge, LA.

Louisiana Department of Natural Resources. 1993. Accretion and hydrologic analysis of three existing crevasse splay marsh creation projects at the Mississippi River delta. Final report to the U.S. EPA, Region 6, Grant No. X-006587-01-0. Baton Rouge, LA. 28 pp.

Louisiana Department of Natural Resources. 1996. Small sediment diversions (MR-01): Progress Report No. 2. Baton Rouge, LA 12 pp.

Louisiana Department of Natural Resources. 2001. Ecological Review: Delta Management at Fort St. Philip. Baton Rouge, LA. 11 pp.

O'Neil, T. 1949. Map of the Southern Part of Louisiana Showing Vegetation Types of the Louisiana Marshes.

Trepagnier, C.M. 1994. Near coastal waters pilot project: Crevasse splay portion. Final report to the U.S. EPA Region 6, Grant No. X-006518-01-2. Louisiana Department of Natural

Resources, Coastal Restoration Division. Baton Rouge, LA. 37 pp.

Turner, R.E., and D.R. Cahoon, eds. 1987. Causes of Wetland Loss in the Coastal Central Gulf of Mexico. Volume II: Technical Narrative. Final report submitted to Mineral Management Service, New Orleans, Louisiana. Contract No. 14-12-0001-30252. OCS Study/MMS 87-0120. 400 pp.

Turner, R.E. 1990. Landscape development and coastal wetland losses in the northern Gulf of Mexico. Amer. Zool. 30:89-105.

U.S. Army Corps of Engineers. 1988. Mississippi River Hydrographic Survey: 1983-1985. U.S. Army Engineer District, New Orleans. New Orleans, LA. 86 pp.

White, D.A. 1993. Vascular plant community development on mudflats in the Mississippi River delta, Louisiana, USA. Aquatic Biology 45:171-194.